

SLIPPAGE IN THE CONSERVATION RESERVE PROGRAM OR SPURIOUS CORRELATION? A REJOINDER

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The Conservation Reserve Program (CRP) pays farmers about \$2 billion per year to retire cropland under ten- to fifteen-year contracts. Recent research by Wu (2000) found that slippage—an unintended stimulus of new plantings—offsets some of CRP's environmental benefits. In a comment on Wu, we argued CRP enrollments were endogenous and confounded by omitted variables. In his reply, Wu (2005) used results from a Hausman test to argue that CRP enrollments are exogenous. In this rejoinder, we explain why the candidate instrument (erodibility) is likely confounded by omitted variables, so Wu's use of the Hausman test is uninformative.

Key words: conservation, instrumental variables, land retirement, slippage, spurious correlation.

Recently in this journal, Wu (2000) reported empirical findings that slippage offsets some of the Conservation Reserve Program's (CRP) environmental benefits. That is, he reported that farmers plant more acreage to replace a share of land idled under CRP. He argues that slippage might arise through a "price-feedback effect," caused by a CRP-induced shift in commodity prices, or through a "substitution effect," caused by substitution of land from a noncropping to a cropping activity. His findings are based on a cross-sectional regression of crop reporting districts that relates new cropland acres to CRP enrollment acres and several control variables.

In a comment (Roberts and Bucholtz, 2005), we argued Wu's slippage estimates likely suffered from endogeneity and omitted variables biases. We were particularly concerned about bias stemming from the fact that parcels enrolled in CRP were of relatively low quality. Crop districts with relatively low land quality are also more prone to cropland expansions and contractions. As a result, one may expect an association between CRP and enrollments and noncropland to cropland conversions that is not causal. To explore this hypothesis, we used Wu's empirical specification to predict *ex-*

iting cropland (cropland to noncropland conversions) and found the model fit nearly as well as Wu's specification for new cropland. Indeed, in our "Wu-reversed" model, every coefficient had the same sign as Wu's original model, despite the fact it attempted to explain the opposite tendency. We viewed this finding as a strong indication of model misspecification.

We attempted to improve Wu's model using an instrument for CRP enrollments—the amount of highly erodible land—which was a key qualification for enrollment in CRP. This variable is strongly correlated with CRP enrollments and is exogenous (more-or-less immutable by farmers' decisions). However, we were worried it may also be correlated with unobserved land quality attributes. In our two-stage least-square estimates, we also made corrections for measurement error and checked the stability of the estimates across several specifications. When estimates are unstable across specifications, it implies the instrument is correlated with observable variables, which suggests it may also be correlated with omitted variables. Our new slippage estimates were extremely unstable across specifications (ranging from 2% to 19%) and, like Wu's original model, yielded coefficients for exiting cropland similar to those for new cropland. These findings suggest that our instrument is likely a poor one: although it was correlated with CRP enrollments, it was also likely correlated with the error. We concluded that the existence and

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magnitude of slippage remains ambiguous.

In reply to our comment, Wu used a Hausman test to test the null hypothesis that CRP enrollments are exogenous (he failed to reject). A Hausman test, however, rests on the assumption that the instrument is valid—that it is correlated with CRP but not correlated with unobserved determinants of land-use change. Because we concluded erodibility was likely correlated with unobserved determinants of land-use change, it is not a valid instrument, and Wu's Hausman test is uninformative (Hahn and Hausman, 2003).

In our comment, we brought up a few other issues, which Wu attempted to address in his reply. We argued that Wu's estimates could not measure slippage stemming from a commodity price-feedback effect because all crop districts experienced the same, single-price change. Wu concurred on this point. We further argued that Wu's description of a "substitution effect" was not well posed or at least not fully specified. In his original paper, Wu described a substitution effect based on the law of diminishing returns—that when a farmer enrolls land in CRP it reduces his relative portion of cropland, so marginal profitability of crop production increases in comparison to non-cropping activities, which causes the farmer to expand his individual cropland acreage. We argued that if this effect arises in a way that is fundamentally different from a price-feedback effect, it must imply land market rigidities or other market imperfection. To clarify this point, consider that we normally view land rents and uses to be reflected in an indirect quasi-rent function $\pi(p, w)$, where p and w are commodity and input prices. Clearly, land rents and uses do not change unless commodity or input prices change. It would seem that Wu has assumed the existence of some kind of farm-level land constraint.

In reply, Wu (2005) introduces an argument for a substitution effect that is distinctly different from the one he originally presented. He argues that the introduction of CRP presents a new opportunity for future uses of cropland. That is, he argues that farmers may bring new cropland into production so they might enroll it in CRP at some future point in time.

Although we agree that the "option value" is surely a valid potential source of slippage, we do not see how Wu's regressions could measure this kind of effect. Like slippage resulting from a price-feedback effect, slippage stemming from the new CRP "option value,"

would have affected all farmers. With regard to the price-feedback effect, in our comment we wrote:

One should not expect new cropland to necessarily arise in the same locations as CRP enrollments. For example, suppose crop district A enrolls land in CRP causing crop prices to rise, which in turn causes crop district B to convert some range land or pastureland to crops. The cross-sectional regressions do not account for slippage in district B induced by CRP enrollment in district A. Unless markets are sufficiently local, slippage arising from the price-feedback effect results from changes in aggregate production, not local production.

Slippage stemming from new CRP-induced option values would be similar to that stemming from a CRP-induced rise in commodity prices. The difference would be that not all remaining noncropland (if converted to cropland) would be expected to be eligible for future CRP enrollments. So unlike prices, option values would be different for different land parcels. But it is in no way clear that option values would arise in proportion to past enrollments. Indeed, one might expect a negative relationship between past enrollments and future opportunities, especially for areas near mandated CRP enrollment thresholds or having little remaining land that might be made eligible for CRP.

We believe Wu's original argument for substitution effects may be partially valid, but the effects hinge on rigidities in land markets that Wu did not acknowledge in his original paper or his reply to our comment. But we expect these effects to be small. Farm entry and exit rates are quite high, farm sizes change markedly over time, and more than half of the agricultural land is rented. Land constraints would seem to be a minor issue, especially relative to other potential sources of slippage.

We remain unconvinced that Wu's regressions (or ours) provide useful information about the incidence of slippage. The topic remains an important one for further inquiry.

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